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DEC 21 09:44

December 15, 2004

14 pages total

**Food and Drug Administration
Division of Dockets Management
5630 Fishers Lane, Room 1061
Rockville, MD 20852**

**Re: Docket Numbers 1996P-0418, 1997P-0197, 1998P-0203, 2000N-0504
Forced Molting of Laying Birds**

Thank you for inviting public comments on the poultry and egg industry practice of force molting laying birds. On April 14, 1998, United Poultry Concerns filed a citizen's petition (Docket No. 98P-0203/CP1), requesting that FDA prohibit the forced molting of laying birds in the United States. The ensuing comments are an extension and a renewal of our request. United Poultry Concerns (UPC) urges the FDA to prohibit forced molting of laying birds based on food safety concerns linked to the inhumane practice of molting birds by food deprivation and/or nutrient reduction designed to manipulate the economics of egg production. FDA has federal authority to regulate food safety on egg farms, where forced molting is practiced. FDA has assured UPC in correspondence that egg safety is a concern of the agency and that FDA is committed to addressing this issue. UPC urges FDA to address the forced molting issue by prohibiting the practice. Thank you for your attention.

Introduction

The food deprivation practice commonly known as forced or "induced" molting of laying hens has been shown to induce significant systemic and infectious disease conditions in these birds. *Salmonella enteritidis* [SE], which has been identified as a major contaminant in shell eggs since the 1980s, has been scientifically linked to the practice of forced molting, making forced molting both a food safety and an animal welfare issue. The United Egg Producers Animal Welfare Advisory Committee summarized in 2000 that "[b]ehavioral and immune system measures indicate that the welfare of the hen is compromised when feed withdrawal or restriction is used to induce a molt" (Armstrong, 2000).

The practice of withholding food from laying hens from five to twenty-one days at a time, or until they lose 25 percent to 35 percent of their initial body weight (Webster, 2000:192), is currently done by 75 percent to 80 percent of the layer industry in the United States (Bell, 1999, p. 68). This practice has been shown to compromise the immune function of the birds so severely

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as to render their eggs a health risk to consumers as well as compromising the well-being of the birds. In particular, *Salmonella enteritidis* (SE) has been linked to forced molting; however, other pathologic changes in force-molted hens have also been identified. These changes, which do not normally occur in naturally molting hens, include a loss of 25 percent or more of body weight attributed to loss of weight “in body fat, feathers, liver tissue, musculature and skeleton” (Bell, 1996, p. 4). In studies, force-molted hens “shed significantly higher numbers of SE during the feed removal period than the unmolted group.” Furthermore,

Histological examination of cecum and colon from molted infected hens revealed inflammation compared with minimal changes in the intestines of unmolted infected hens. Molting, in combination with an SE infection, created an actual disease state in the alimentary tract of affected hens. (Holt & Porter, 1992:1842)

The USDA’s Food Safety and Inspection Service (FSIS) has acknowledged that “public health concerns are raised by highly stressful forced molting practices [which] lead to increased shedding of *Salmonella enteritidis* (Se) by laying hens subjected to these practices” (Stolfa, 1998). In 1999, a General Accounting Office Report on food safety identified forced molting as a primary factor associated with increased levels of *Salmonella enteritidis* in commercial laying flocks (GAO, 1999, p. 25), and *Egg Industry* magazine observed that “[r]educed feed and water intake is the most detrimental and universal aspect of disease” in laying hens (Beckman & Grieve, 1999, p. 10).

Background on Forced ("Induced") Molting in the United States

"Induced moulting is a form of starvation" (Holt, 1992:165). The U.S. poultry and egg industries use food deprivation as an economic tool to manipulate egg production in commercial laying hens and in male and female birds used for breeding of both egg-type and meat-type birds (North & Bell, pp. 433-452). Prolonged food withdrawal with light-dark manipulation (“altered photoperiod”) is the most common method of forced molting in the United States (Holt, 1992:165). The three main methods of forced molting are (1) elimination or limitation of food and/or water; (2) feeding the birds low nutrient rations deficient in protein, calcium or sodium; (3) and administration of drugs, hormones, and metals including methalibure, chlormadinone, and progesterone, high levels of iodine, dietary aluminum, and zinc (Bell & Kuney, 1992:201). Bell reports that “[o]ver the years, most flock managers have eliminated the removal of water and have increased the number of days of feed removal” (1996, p. 4).

In standard forced molting practice, artificial light-dark manipulation accompanies the removal

of food from the birds. For example, a 1-week pre-molt cycle of 16 hours of light/8 hours of dark may be followed by a molt schedule consisting of 8 hours of light/16 hours of darkness (Holt and Porter, 1992). Or a 1-week pre-molt cycle of 24 hours of continuous light is followed by 8 hours of light which is increased on day 20 by .25 hours/week back up to the standard 16-17 hours of continuous light (Kalmbach Feeds). According to food microbiologist James L. Smith of the U.S. Department of Agriculture's Eastern Regional Research Center in Philadelphia, the changing of light patterns to manipulate egg laying increases *Salmonella* colonization of laying hens (*Food Chemical News*, p. 5).

Commercial laying hens are sent to slaughter at 17 to 18 months of age (72-80 weeks), or they are kept for another laying cycle, or two (105+ weeks). Their food is removed or nutritionally reduced causing the hormone levels that induce egg production and inhibit feather growth to drop. New feathers push out old ones and the hen stops laying for one or two months instead of three or four. By the 10th to 14th day of total food deprivation, a hen who weighed 3.65 pounds before the molt weighs 2.56-2.73 pounds (Kalmbach Feeds). In *Commercial Chicken Production Manual*, North & Bell state that "A fast [sic] of 4 days will usually cause a flock to cease egg production. Longer fasts [sic] of up to 14 days will usually give superior results, but extreme care must be taken to monitor body weight losses and mortality" (1990, p. 434). A method developed at North Carolina State University includes a week of 24-hour continuous artificial lighting prior to food deprivation for 14 days or longer (North & Bell, 1990, p. 439).

Forced molting is designed to extend the "economically useful life" of laying flocks in order to "reduce the cost of a replacement program," and to regulate market prices (North & Bell, 1990, p. 445; Bell, 1996, p. 3; Smith, 1997, p. 8). The economic benefits include not having to feed the birds during the molt and feeding them cheap, inferior rations before and after the molt (Bell, 1996, pp. 3-4). These savings, based on egg value minus feed cost, explain why the majority of the U.S. egg industry, unburdened as it has been by either legal or ethical considerations, has opted to starve hens to make them molt rather than feed them an altered diet that is capable of producing comparable results (Smith, 2002, pp. 8, 27). Since the 1960s, forced molting ("recycling") has been the dominant method of flock replacement for the U.S. table egg industry. In forced-molting terminology, "replacement flock" refers to the same birds--the dwindling number of survivors--used over and over. According to Bell, at any given time in the United States, approximately 70 million laying hens out of a total of 250 million hens are being force-molted or have been force-molted as many as three times, "with disposal ages ranging from 75 to 140 weeks of age" (Bell, 1999, p. 68).

Forced Molting Impairs Birds' Immune Systems

Induced moulting is a form of starvation and a body of literature has shown that dietary restriction can alter humoral and cell-mediated immunity. Overall, deficient diets have been found to diminish humoral immune responses in humans, rats, mice, and chickens. A variety of effects of similar diets on cellular immune responses were also observed. (Holt, 1992:165)

In 1992, U.S. Department of Agriculture immunologist Peter S. Holt reported a USDA study in which white leghorn hens and white rock layer flocks were deprived of food for 14 days. He wrote that "[f]ood deprivation as a means of inducing a moult in laying hens had a variety of effects on the immune system of the birds. The number of circulating lymphocytes were significantly decreased in the moulted group compared with the control birds." Observing that "[c]ell-mediated immunity is a very important component of the immune system and any procedure which modifies its effectiveness could have profound effects on the well-being of the bird, Holt found that the "DTH [delayed type hypersensitivity response] to the skin sensitizer DNFB, an indicator of cellular immune responsiveness, was significantly depressed during the moult procedure" (Holt, 1992:170).

Depressed Immunity Invites SE Colonization of Force-Molted Hens

Forced molting is the infliction of a "trauma" that encourages disease (Holt et al., 1994:1268). According to Holt, "Studies in the authors' laboratory have shown that induced molting significantly depressed the cellular immune response and increased the severity of a concurrent intestinal *Salmonella enteritidis* (SE) infection." Microbiological analysis of early *Salmonella enteritidis* infection in molted and unmolted hens has shown that "induced molting has a profound effect on both intestinal and extraintestinal infection by *S. enteritidis*, and these effects occur within 24 hr postinfection in the intestine and within 48 hr postinfection in the livers and spleens" (Holt et al., 1995:55).

Withdrawal of feed changes the dynamics of an intestinal infection in hens. In contrast to unmolted hens, in which *S. enteritidis* was somewhat localized primarily in the cecum, the molted hens exhibited intestinal *S. enteritidis* infection distributed more along the intestinal tract. In these fasted [sic] hens, the *S. enteritidis* recovery rate was equivalent for colon, cecum, and feces over the first 72 hr, and at 72 hr even the percent recovery of the challenge organism in the ileum equaled that of the other tissues. (Holt et al., 1995:61)

Forced Molting Promotes Transmission of SE Via Stress, Rodents, and Feces

In addition to encouraging SE colonization of individual hens, forced molting encourages SE organisms to spread to other hens in the confinement environment (Holt et al., 1995:62). SE was transmitted "more rapidly to the unchallenged hens in the adjacent cages of molted hens than in unmolted hens, and these molted hens shed significantly more of the organism than unmolted hens [indicating] that induced molting can have substantial effects on transmission of *S. enteritidis* to uninfected hens, which could affect the overall *S. enteritidis* status of a flock" (Holt, 1995:239). One reason for these "substantial effects" on SE transmission is stress.

The stress of molting thus appears to result in an increase in intestinal numbers of *S. enteritidis* and the transmission to uninfected hens. . . . Stress has also been shown to cause the reactivation and transmission of infectious laryngotracheitis virus in hens. (Holt, 1995:248)

Another reason is rodents. Studies have shown mice to be significant amplifiers of *S. enteritidis* infection in layer operations.

Mice can shed large numbers of the organism in their feces (up to 10^5 *S. enteritidis* per fecal pellet), and the infection may persist in the mouse population for long periods, even after the poultry houses have been cleaned and disinfected. Mice carrying even low levels of *S. enteritidis* could conceivably infect hens during molting. Because induced molting has been shown to exacerbate concurrent *S. enteritidis* infection, resulting in the shedding of large numbers of the organisms, molted hens could serve as a second amplifier of *S. enteritidis* infection, spreading the organism to other molting hens (and to mice) within a layer operation. (Holt, 1993:416-417)

Still another reason for the "substantial effects" of forced molting on SE transmission is feces.

[A]lthough molted hens produce diminished amounts of fecal matter during the period of feed removal compared with fed hens, they still shed large numbers of *S. enteritidis* into the room environment. The combined effect of acutely susceptible hens exposed to the large numbers of *S. enteritidis* released into the room resulted in the increased transmission of the organism. Following further rounds of intestinal amplification, the organism readily cycled down the line of susceptible hens. (Holt, 1995:248)

Contaminated Feather Consumption By Forced-Molted Hens

Feathers are mainly composed of the protein, keratin. Amino acid deficiencies such as low

arginine content in the food have been indicated as a cause of abnormal feather pecking in confined birds (Vestergaard et al., 1993:1127). Force-molted hens pluck and consume the feathers of adjacent hens in a desperate effort to reduce their hunger. Feathers contaminated with *Salmonellae* remain contaminated for long periods. In the forced-molting environment, the spread of *Salmonella enteritidis* through flocks appears to be increased by hens consuming the contaminated feathers of adjacent birds (Holt, 1995:248). The hens must thus endure not only hunger and body depletion but the stress and pain of being plucked by their equally desperate cagemates. The pain of plucking is explained by Gentle and Hunter:

Nociceptors [pain receptors] have been identified in the skin of several avian species and the detailed stimulus-response characteristics of these receptors have been determined in the chicken. The follicular wall of the feather is richly supplied with general somatic afferent (sensory) fibres and nerves are present in the papilla, pulp and feather muscles. . . . The feather is firmly held in the follicle. (Gentle and Hunter, 1990:95)

Behavioral Indicators of Suffering in Force-Molted Hens

Comparing a bird's capacity to suffer with that of a mammal, Gentle states that "with regard to the anatomical, physiological and behavioural parameters measured, there are no major differences " (1992:235). Pain receptors, thermo-receptors, and physical-impact receptors responsive to noxious (tissue damaging) stimuli have been identified in birds and characterized in chickens. Like mammals subjected to aversive stimuli, chickens show a rapid increase in heart rate and blood pressure, and behavioral changes consistent with those found in mammals, including efforts to escape, distress cries, guarding behavior, and passive immobility characteristic of animals subjected to trauma that continues regardless of their attempts to reduce or eliminate it (Gentle, 1992).

Chickens deprived of food show pronounced suffering. Contrary to assertions that hens do not suffer in being force molted, Duncan and Mench maintain that the evidence presented "does suggest suffering:"

[T]he increased aggression suggests severe frustration and the increased non-nutritive pecking, some of which was stereotyped, suggests severe frustration and extreme hunger, and the reduced activity suggests debilitation (*Poultry Science*, 2000:934).

As further evidence of animal suffering, they cite molting results from 353 U.S. flocks during 1997 and 1998, which showed that "mortality typically doubled during the first week of molt, then doubled during the second week."

A force-molting study published in *Applied Animal Behaviour Science* showed similar results. Observing that “the hens were highly motivated to perform feeding behaviour and were prevented from doing so” by the researchers, and that “[t]he different types of behaviour pattern which are typical during frustration are displacement movements, escape behaviour, aggression and stereotypies,” Aggrey, et al. wrote that “the hens were hungry and were looking for food,” and “kept pecking the empty feeding trough, walls and floor.” They noted “an increase in negative social interaction,” stating that the “increase in negative social interaction may inflict pain which is very important in the evaluation of the wellbeing of the hens.” While noting that the frustration behavior appeared to be less in caged hens than in hens on a wire floor system, the researchers cautioned that cage constraints which suppress normal animal behavior are “by no means better for animals. Cages can only allow pseudo-behaviour and therefore cannot be judged as adequate for hens” (Aggrey, et al., 1990:103).

Chickens’ cognitive complexity may increase their ability to suffer in being force molted. Cognitive research shows that “the chicken is not an inferior species to be treated merely as a food source” (Rogers, 1995, p. 213), and that in all relevant respects, “birds have cognitive capacities equivalent to those of mammals, even primates” (p. 217). Forced molting subjects an already overstressed bird, characterized as “having a complex nervous system designed to form a multitude of memories and to make complex decisions,” to significantly more stress than she is already being forced to cope with (p. 218).

Chickens in battery cages are cramped in overcrowded conditions. Apart from restricted movement, they have few or no opportunities for decision-making and control over their own lives. They have no opportunity to search for food and, if they are fed on powdered food, they have no opportunity to decide at which grains to peck. These are just some examples of the impoverishment of their environment. Others include abnormal levels of sensory or social stimulation caused by excessive tactile contact with cage mates and continuous auditory stimulation produced by the vocalizing of huge flocks housed in the same shed. Also, they have no access to dustbathing or nesting material. Chickens experiencing such environmental conditions attempt to find ways to cope with them. Their behavioural repertoire becomes directed towards self or cage mates and takes on abnormal patterns, such as feather pecking and other stereotyped behaviours. These behaviours are used as indicators of stress in caged animals. (Rogers, p. 219)

Starvation and Fasting Are Not the Same.

"Anorexia" means loss of appetite or refusal to eat, not food removal. Force-molted hens do not stop eating because they lose their appetite or don't want to eat, but because their food is taken away from them. A visitor to an egg farm in Pennsylvania wrote regarding the first day of a 7-day starvation program, "When the lights came on, the cackling and clucking rose to a cacophony, accompanied by the sound of thousands of beaks pecking on metal" (Geist, 1991, p. 3).

Naturally-molting hens do not go for days and weeks without eating, while a hen with a clutch of eggs leaves her nest for ten to twenty minutes each day until her chicks are ready to hatch, to forage for food, drink water, defecate, and exercise. Artificially-incubated eggs must be cooled for 15 to 20 minutes a day to match the time the hen is away from her nest. Mrosovsky and Sherry observe that

While it is presumably possible in theory that the hen is getting hungrier and hungrier as she sits on the nest, a much more elegant and safer solution to the problem would be to lower the set-point [for body fat] and avoid clashes between incubating and eating. Similarly, in the case of hibernators, the motivation to hibernate would have to be very strong to overcome the temptations of food lying right under the animal's nose. (Mrosovsky and Sherry, 1980:839)

Fasting is self-imposed behavior, not food removal. To fast means to abstain from all or certain foods. Fasting originates within an individual or a species as part of a larger purpose or activity that is meaningful to that individual or species, e.g., hibernation, migration, or hatching chicks. A brooding hen is engaged in normal species behavior that is meaningful for her and has no resemblance to the frightening experience of being arbitrarily deprived of food. Mrosovsky and Sherry summarize that when animals fast in nature, fasting is part of their being "engaged in other important activities that compete with feeding" and that evidence shows fasting to be "physiologically different from starvation" (p. 840).

Whereas a brooding hen and a naturally-molting hen are fully intent upon "other important activities that compete with feeding," the hen being starved in confinement has been stripped, without compensation, of her only pleasure, virtually her only activity in confinement, which is eating. Moreover, and most significantly, animals fasting in nature do not generally suffer from immune system breakdown and disease, whereas force-molted hens do. In force-molted hens, cellular immunity is "significantly depressed during food deprivation," and SE infection and transmission are increased (Holt, 1992:173).

USDA Summary of Disease Causality Associated with Forced Molting

Holt summarized the causality between the withholding of food, immunosuppression, and diseases in hens including, but not confined to, *Salmonella enteritidis*, in a review paper obtained by United Poultry Concerns through a Freedom of Information Act request to the USDA, June 3, 1999 (Marquis, 1999). This undated 13-page paper, "Impact of Induced Molting on Immunity and Salmonella enteritidis Infection in Laying Hens," cites studies showing that deficient diets diminish cell-mediated immunity in mammals and birds, and that a concurrence of systemic and infectious disease conditions likewise occurs in force-molted hens (Holt, n.d.). According to Holt, to cite key points:

- "An altered immune response was also observed in birds subjected to induced molting through feed withdrawal" (p. 3).
- "Total peripheral blood lymphocyte numbers were significantly decreased in molted birds" (p. 3).
- "Elevated levels of serum corticosterone were detected during times of stress [in birds and mammals in other studies]. . . . A similar elevation in this stress hormone was noted in hens subjected to feed removal . . . which may be responsible for observed effects on immunity during an induced molt" (pp. 3-4).
- "Protection [of internal organs from pathogens] is mediated by effector T cells and by a battery of hormone messages called lymphokines which regulate the intensity of the immune response and define what effector cells will play a role in the protection. Breaching this immunity can dramatically alter its ability to protect the host against infection" (p. 4).
- "The discovery [was] that the immune system in molted hens was compromised" (p. 4).
- "The potential problems associated with the presence of *S. enteritidis* in the flock environment therefore become exacerbated when birds are exposed to a stress situation such as feed removal" (p. 5).
- "Stress situations can reactivate a previous infection . . . and feed withdrawal to induce a molt can also cause the recurrence of a previous *S. enteritidis* infection" (p. 5).

- “[R]ecrudescence of infection was observed significantly more often in molted birds. [T]hese birds shed significantly more *S. enteritidis* and more readily transmitted the organism to previously uninfected, but contact-exposed hens” (p. 5).
- “The molted hens also produced more eggs contaminated with the organism” (p. 5).
- “[I]ntestinal spirochete infections were more severe in molted hens, indicating that, similar to what was observed for *S. enteritidis*, molting upset the equilibrium normally attained between the host and that parasite” (p. 7).
- “Perhaps more telling is the study conducted by the *S. enteritidis* Pilot Project in Pennsylvania (U.S. Department of Agriculture 1995) which showed that the production of eggs contaminated with *S. enteritidis* increased during the molt. These data prompted the authors to categorize molting as a risk factor for *S. enteritidis*” (p. 7).

In their Interpretive Summary of the “The Effects of Induced Molting on the Severity of Acute Intestinal Infection Caused by Salmonella Enteritidis,” Holt and his colleagues conclude:

These results are important to the layer industry since they show that a prevalent industry procedure has a substantial effect on the severity of an SE infection and these effects are observed early in the disease process. Also, many organisms infect poultry and if molting has such rapid effects on an infection by SE, it is very possible that it could have similar effects on infection by other poultry disease agents. (Macri, et al., 1998:1)

Forced Molting Has Been Widely Condemned and Abandoned

The Canadian Veterinary Medical Association and the Scientific Veterinary Committee for the European Union formally opposes forced molting. At its annual meeting on July 23, 2004, the American Veterinary Medical Association (AVMA) voted to ban forced molting through the use of food and/or water withdrawal stating that “neither water nor food should be withdrawn.”

Food deprivation, the most common method of forcing a molt, was banned in the United Kingdom and then in the European Union as both cruel and unsafe. According to the UK Welfare of Livestock Regulations (1994), “except in the case of therapeutic or prophylactic treatment, all laying hens shall have access to adequate, nutritious and hygienic feed each day in sufficient quantity to maintain them in good health and to satisfy their nutritional needs, and to adequate fresh drinking water at all times.”

The U.S. Department of Agriculture's Food Safety and Inspection Service, the United Egg Producers Animal Welfare Advisory Committee, Consumers Union, Center for Science in the Public Interest, and other consumer groups have requested the forced molting be stopped. In 2000, the McDonald's Corporation banned the purchase of eggs from force-molted hens followed by Burger King and Wendy's International in 2001.

Conclusion

Forced molting is not therapeutic, prophylactic, or humane. It is not a "rest" but the deliberate infliction of physiologic and cognitive trauma and stress. It is so inimical to the wellbeing of birds subjected to the practice that it impairs their immune systems, encouraging them to develop and spread diseases including *Salmonella enteritidis*.

United Poultry Concerns thanks FDA for inviting comments on the forced molting of laying birds. We urge FDA to prohibit this practice without further delay.

Sincerely,



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Submitted via USPS December 15, 2004

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Marquis, M.S. (FOIA Officer, Legislative and Public Affairs, USDA.)

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